SCIENTIFIC NOTE

SOME OBSERVATIONS ON REARING THE SILVERFISH *HETEROLEPISMA SCLEROPHYLLUM* SMITH (ZYGENTOMA: LEPISMATIDAE: HETEROLEPISMATINAE)

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Summary

A basic method for rearing *Heterolepisma sclerophyllum* is provided. It appears that this species might only take water by mouth in contrast to the Ctenolepismatinae which are capable of absorbing moisture from the atmosphere via their anus.

Key words: Thysanura, culture, *Heterolepisma*

INTRODUCTION

Silverfish belong to one of the most primitive of insect groups and probably first appeared about 400 MY (Misof, *et al*., 2014). They have therefore survived both mass extinctions at the end of the Triassic and Cretaceous periods (201 and 66 MY respectively) and are, superficially at least, not much changed from 99 million year old fossils in Burmese amber, which have been placed within extant genera. Today silverfish can be locally abundant but usually restricted to niche habitats such as dry deserts and subterranean (Smith, 2017). Their survival can probably be attributed to, among other things, their polyphagous diet, including having intrinsic cellulase (Treves & Martin, 1994) and their extraordinary speed and agility, which makes them difficult for both predators and entomologists to catch. Their cryptic colouration, covering of scales and long macrochaetae probably also make them even more difficult for predators to get hold of and their ability to regrow appendages after every moult means they can easily shed a leg or other appendage if it is grabbed by a predator. They continue to moult long after reaching sexual maturity, and are long-lived (several years), mating between each moult.

Several species have been reared successfully under laboratory conditions. These are mainly the economically important species *Ctenolepisma longicaudatum*, *Thermobia domestica* and *Lepisma saccharinum* (e.g. Lindsay, 1940, Adams, 1933 and Laibach, 1952) but other species have been held under similar conditions without difficulty. It is generally not necessary to provide free water to these xerophilic species as they are capable of extracting moisture from the atmosphere through their rectum (Noble-Nesbitt, 1970). For example, members of the Entomological Society of NSW keep *Ctenolepisma longicaudatum* for demonstration purposes. These are simply kept in a jar with rolls of cardboard providing cracks in which to hide and offered rolled oats as their only food. They do however quickly feed on any other higher protein material that may be offered. They do notrequire any water. I have found however that breeding is more successful if handling is minimised. Emptying the jars to count numbers can result in quite a reduction in numbers over the following weeks.

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The Nicoletiidae on the other hand, are generally soil dwellers or live in other subterranean habitats. Dougherty Picchi (1972) reared one species, the parthenogenetic *Nicoletia phytophila* (as *Nicoletia meinerti*) on lettuce leaves, finding humidity was the most important factor in rearing these animals. She found that the silverfish avoided droplets of water but congregated around substrate that had just absorbed water. Many species of Nicoletiidae have eversible vesicles on the posterior margin of several abdominal sternites and it is believed that these are involved in water absorption from surfaces, at least for the even more primitive jumping bristletails (Microcoryphia) (Houlihan, 1976).

Silverfish of the predominantly Australian subfamily Heterolepismatinae have not been studied. Although some species can be collected in dry desert regions, the subfamily is most common in areas of higher rainfall such as along the east coast of Australia. Some species can even be collected in or near rainforest but only from microhabitats which do not remain wet for long, such as the bark of trees or leaf litter accumulations in the axils of plants.

OBSERVATIONS

About 20 *Heterolepisma sclerophyllum* Smith, 2014 specimens were collected from Broulee, NSW, the type locality of the species, in November 2010 and again in February 2016. They were collected by grabbing handfuls of *Eucalyptus* spp. leaves that had accumulated in axils of *Macrozamia* fronds (Zamiaceae) (Figure 1) and were transferred to a glass jar along with leaves and leaf litter.

Specimens collected in 2010 were initially held without water as for other species of Lepismatidae. They were offered small amounts of commercial goldfish food which they were observed eating. Several were found dead and shrivelled over the following weeks, especially smaller specimens.

Figure 1. *Eucalyptus* spp. leaves trapped in the base of the fronds of a *Macrozamia* plant at Broulee, NSW- the habitat in which these silverfish live naturally.

The leaf litter appeared very dry so it was lightly sprayed with water at intervals of several days and some silverfish were seen contacting the drops of water with their mouths. However before long fungus growth on the leaves occurred and the rest of the population died.

Specimens collected in 2016 were also held in a jar with leaf litter and covered with mosquito netting (Figure 2) to exclude the entry of predators; they were offered goldfish food at irregular intervals. However this time they were also offered several tubes of water with cotton wool stoppers (Figure 3). They were kept at room temperature in two Sydney homes which probably varied over the year from 12°–30°C.

Once the numbers increased to reasonable levels it was common to see silverfish sitting on the cotton wool stopper (Figure 4), generally with their mouth against the cotton wool. As tubes became empty and the cotton wool pulled away from the sides of the tube, the silverfish could sometimes be found inside the tube. It is not possible to know if they were valuing the higher humidity or just the space as a refuge.

They seem to survive long periods if no goldfish food is offered but numbers appeared to increase faster (more small nymphs observed) when food was more or less continuously available. Both pelleted and flaked goldfish food were eaten (e.g. “Marina Master Goldfish Flake Plus for coldwater fish” from VitaPet).

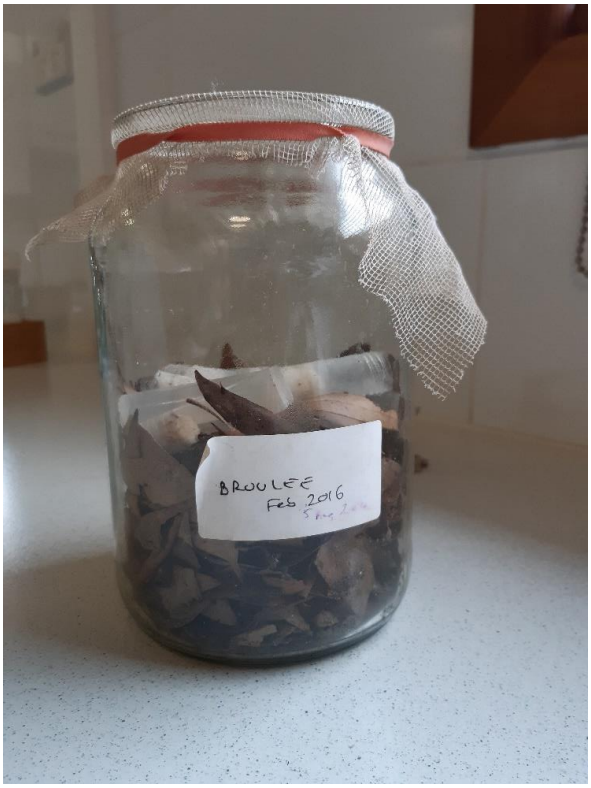

Figure 2. Jar with leaf litter, water tubes and netting cover

Figure 3. Water tube with cotton wool stopper

One easy way to remove small numbers of silverfish from the culture without disturbing the litter and damaging their scale covering is to examine the water tubes each morning. It is easy to remove a tube from the jar without disturbing the drinking silverfish and tap it over the container into which you want them deposited. Silverfish are unable to climb smooth surfaces so they are easy to confine.

Figure 4. *Heterolepisma sclerophyllum* taking water from the cottonwool stopper.

DISCUSSION

It seems that this species, and possibly all or most Heterolepismatinae, might not have the ability to absorb moisture from the atmosphere but instead take it by mouth. This needs further investigation before it can be stated with certainty, perhaps using the simple but effective methodology of Noble-Nesbitt (1970) where melted wax was used to block either the anus or the mouth of somewhat water-deprived silverfish, followed by measurement of rehydration (by weight gain) when these insects were placed into a high humidity environment.

The method of keeping *Heterolepisma sclerophyllum* described here seems to work well and requires little effort. It might be worthwhile placing the collected leaf litter (minus its silverfish) into a freezer for a week before adding the silverfish to ensure any predators that might have been incidentally collected are first killed. Alternately, Molero-Baltanás (pers. comm., 2020) has disfested the litter by heating in a laboratory oven at about 80°C. The simple culture method described here could no doubt be much improved by finding the optimum temperature and humidity for the species.

Very little is known about the biology of non-pest species of silverfish. This is partly due to the lack of interest and funding for work on comparatively unattractive and not economically important insects. Their long life cycle makes it difficult to create short student projects to answer some of the basic questions. Hopefully it will now be possible to breed up enough specimens over the next year or so that they can be supplied in sufficient numbers to enable work to be carried out within a practical time frame, should anybody show interest.

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